An introduction to OPEN EMS Software Product Series

May, 2014

OSS BroadNet

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Company Overview

- Head Quarter:
  - 3-5-7, Hisamoto, Takatsu-ku, Kawasaki-city, Kanagawa, Japan
- Main Businesses:
  - Software development, sales & support
- Main Products:
  - OPEN ADMIN/STM for Cable market
  - OPEN EMS for Utility market
- Sales Partners:
  - Net Save (KanDenKo group), Itochu-Cable System (Itochu group), Next Cadix (Next ware group), NTT Data, etc.
- Customers (Cable):
  - J:COM, Himawari, NNS, etc. (Roughly 50 SOs, 20 independents)
- Customers (Utility):
  - F-BIT Communications (Energy aggregator for MDU, independent)
    - AMI system with PLC (Data Collector & MDMS)
    - Commercially launched in 2011
  - Family Net Japan (Energy aggregator for MDU, TEPCO group)
    - AMI system by FTTH & PLC (Data Collector & MDMS & Usage visualization)
    - Application server for energy usage visualization & recommendation
    - Embedded software for smart meter & concentrator (AES encryption)
    - Commercially launched in 2013

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What's OPEN EMS Series?

OPEN EMS（Open Energy Management System）series is a suite of AMI software components for utilities.

- Complying with IEC62056 DLMS/COSEM international standard.
  - Communicate with low-cost, mass production based IEC62056 smart meters.
  - Shorten the time to market of developing IEC62056 smart meters & concentrators.

- Being ready for the coming liberalization in 2016 in Japan.
  - Provision, manage smart maters' configuration & registration.
  - Collect measured values periodically from mass maters in a reasonable timeframe.
  - Control meters remotely.
  - Provide measurement logs to northbound BSS.

- With various options.
  - Visualize kWh, A, V, bills, CO2 for any HTML browsers / Android devices.
  - Generate "negawatt" power by mater-based ADR.
  - Automate configuration & provisioning, reduce miss-configuration and truck rolls.
  - Establish comprehensive security platform by public key encryption mechanism.

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Advantages & Benefits

- **Flexible scalability by distributed architecture**
  - From 20,000 to 1,200,000 meters can be managed by one EMS domain.
  - Start from minimum configuration, expanding in a step by step manner.
- **Developed by ourselves**
  - Easy to customize for each country's specific cultures.
- **Low cost, High performance**
  - Divert our existing engineering assets, DOCSIS cable monitoring product codes, to AMI.
- **Most part of core architecture is derived from real, commercial AMI projects**
  - Based on our experiences of metering, PV generation & compensation, EV billing, HEMS monitoring & control, smart receptacle with Zigbee / ECHONET, ADR, PLC, Wireless, etc.
- **Readiness for multi venders, multi technologies**
  - Embedded agent for smart meter divides communication function block from mater main block, which makes systems architecture independent from manufacturers' proprietary specifications.
  - Flexible for various medias, ex.) PLC, wireless, FTTH and Cable.
- **Low cost HA option**
  - 1:1 duplex system by DRBD & Pacemaker, open source HA architecture could be configured.
  - VM Ware could also be used, if customer prefers enterprise commercial license than open sources.
- **Comprehensive security design**
  - Authentication & encryption are configured between Head-end and Meters, means end-end.
  - No dependency with any partial network policies of access lines or backhauls ex.) PLC, Wi-SUN or LTE.
- **Original ADR option**
  - An OpenADR derivative for "Negawatt" generation.
  - Listen EiEvent signal from DRAS, evaluate with pre-configured policy, change configured capacity of maters.
  - "Consumption simulation" function kindly initiates end-users to configure their own ADR policies.

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OPEN EMS Products

OPEN EMS (Open Energy Management System product series)

•HE (Head-End data collector)
Head-end side daemon program to communicate with various physical devices.

•MDM (Meter Data Manager)
MDMS managing maters, storing & analyzing data collected from meters for efficient energy management.
Northbound APIs and various options ex.) ADR or alert notification could be configured.

•CE (Centralization Engine)
Aggregate distributed EMS stations (MDMs) for northbound OSS/BSS.

•VPS (Visualization of Power at Server side)
HTTP application server to output MDM data to viewers (HTML browsers or VPA application).

•VPA (Visualization of Power by Android)
Android application to visualize energy consumption indices, communicating with VPS by http.
Could be downloaded onto CATV-STB, OTT-STB or Android based tablet.

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OPEN LIB Products

OPEN LIB (Open Library product series)

•EA (Embedded Agent)

Daemon program written in Java & C, could be ported to any Linux embedded devices.

Can automate most part of provisioning & configuration processes by communicating with PROV at head-end.

Support firmware update, end-end authentication & encryption and monitoring as an remote agent.

•PROV (Provisioning platform)

Provision EA embedded devices in accordance with pre-configured policies, register status info of activated devices into MDM.

Shorten truck roll, Reduce human errors.

•ALA (Application Level Authentication platform)

A software to encrypt any part of network at application level, providing capabilities of client & server authentication and periodic common key update.

Applicable for both pull & push. “Pull” means to collect data from EOL sensor devices to head-end, whereas “push” means to provide personalized information from head-end to end user viewers.

•AG (Application Guardian)

A monitoring software & rule-based automation engine to switch to stand-by HE when detected something wrong in any one of HEs.

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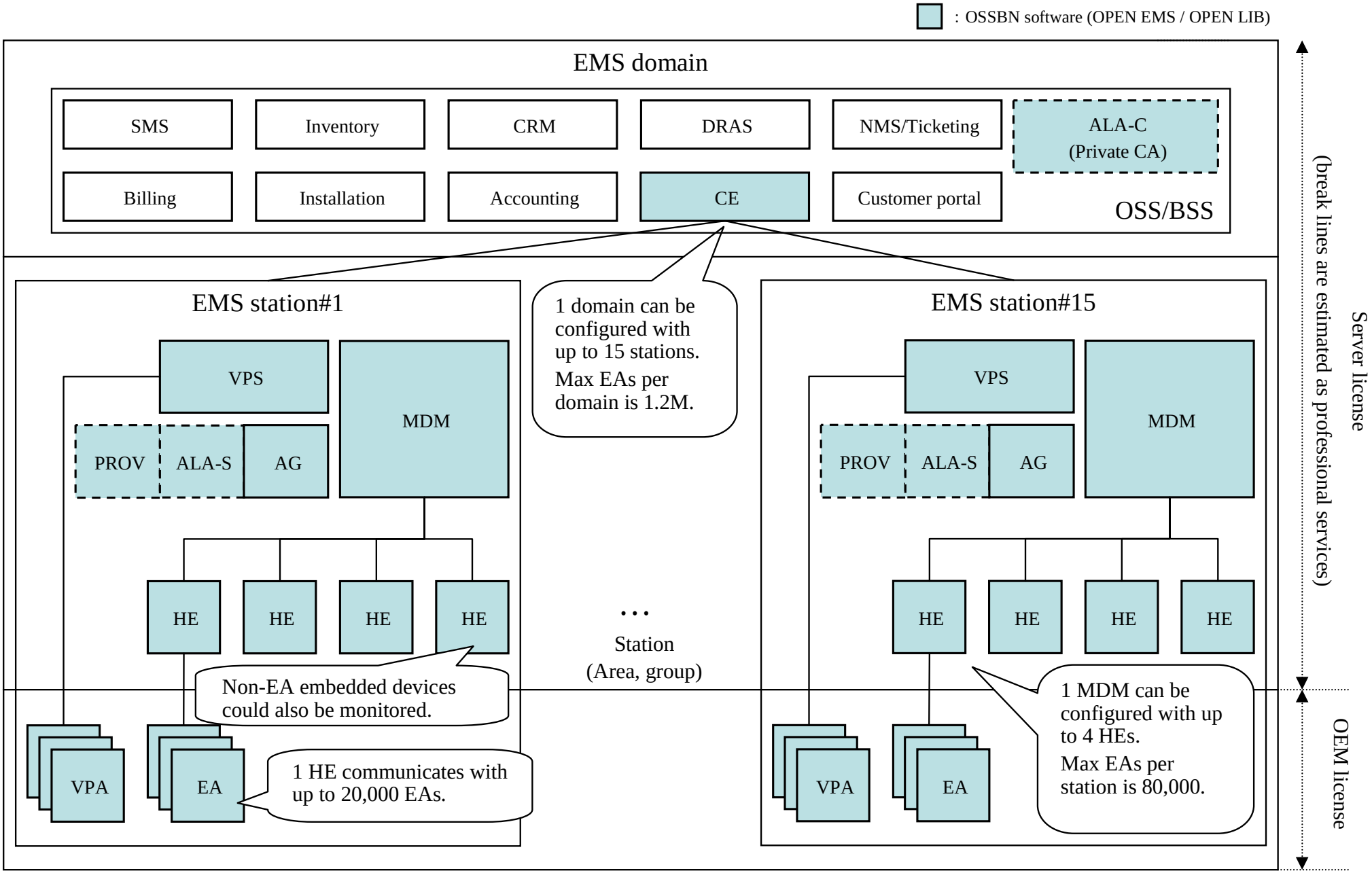
Position of Products



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Function List (MDM)

Function	Category	Description
Configuration management	Standard	Configuration of MDM and each HE (up to 4 processes).
Periodic processing		Collection log import, usage log export. Synchronize MDM-DB and HE-DB. Quoted bill import. Called from cron.
Daily processing		Device list import. log size maintenance. Called from cron.
Monthly processing		Currently no specific implementation. Mainly for customization. Called from cron.
HTTP-API		RESTful APIs for northbound systems. Used for device activity test, device registration/disposal/placement/displacement, polling start & stop, relay switching, capacity change, mass meters reboot, etc.
SQL-API		SQL stored procedures for northbound systems. Called from VPS, PROV, ALA and billing system. Used for usage log output, missing record list generation for re-poll, bill import, VPS account management, ADR policy management, VPS log output, ADR log output, etc.
IEC61968 *E6~		Implementation of DCIM data model & protocol of IEC61968 suites. HTTP-API mapping to IEC61968.
Operation log		MDM operation log output to Syslog.
ALA integration		MDM-DB connection to record ALA related info. Ex.) certificate life cycle info, authentication & encryption profile, etc.
PROV integration		MDM-DB connection to record type & address & status info of detected device. Device deactivation synchronization.
NMS integration		Device search API. Reset API. Alert event generation & notification.
VPS integration	Optional	Quoted bill import, or simulate (self-generate) bill for VPS. Export data to customer portal or VPA.
Mater ADR *E5.3~		Designing of ADR policy (from/to time, thresholds, acceptable savings etc.) in accordance with past consumption tendencies. When EiEvent received, make decision whether ADR action is required. If yes, issue reservation command to the meter to change capacity. ADR action log (= contribution result) forwarding to northbound for incentive identification.
OpenADR *E6~		Receive EiEvent from DRAS, forward the event to EA via HE-API, summarize action result, report to northbound.

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Function List (HE)

Function	Category	Description
Configuration management	Standard	Configuration of HE by editing text file.
Periodic processing		Periodic meter polling via concentrator or directly. Collection log file (snapshot) generation in every configured period.
HE-API (Low-level API)		Remote API called from MDM or other northbound applications. When requested, convert protocol, issue command to targeted physical device, respond to requester with result code. Only 3 generic methods are supported. Get, Set and Execute. Currently implemented by Java as RMI-API.
Operation log		HE-JVM console log output to text file.
IEC62056		Implementation of COSEM/DLMS data model & protocol of IEC62056 suites, used for communication between head-end and smart meter. Cannot co-exist with any other protocols in a same HE.
ANSI C.12 * Currently no plan to support.		Implementation of ANSI C.12.22/C.12.19, used for communication between head-end and smart meter. Cannot co-exist with any other protocols in a same HE.
OpenADR *E6~	Optional	EiEvent message forwarding.
ECOP		Implementation of ECOP by FUJI-IT, used for communication between head-end and smart meter. Cannot co-exist with any other protocols in a same HE. Vender proprietary.
STiNC		Implementation of ECOP by TOKO-TAKAOKA, used for communication between head-end and concentrator. Cannot co-exist with any other protocols in a same HE. Vender proprietary.

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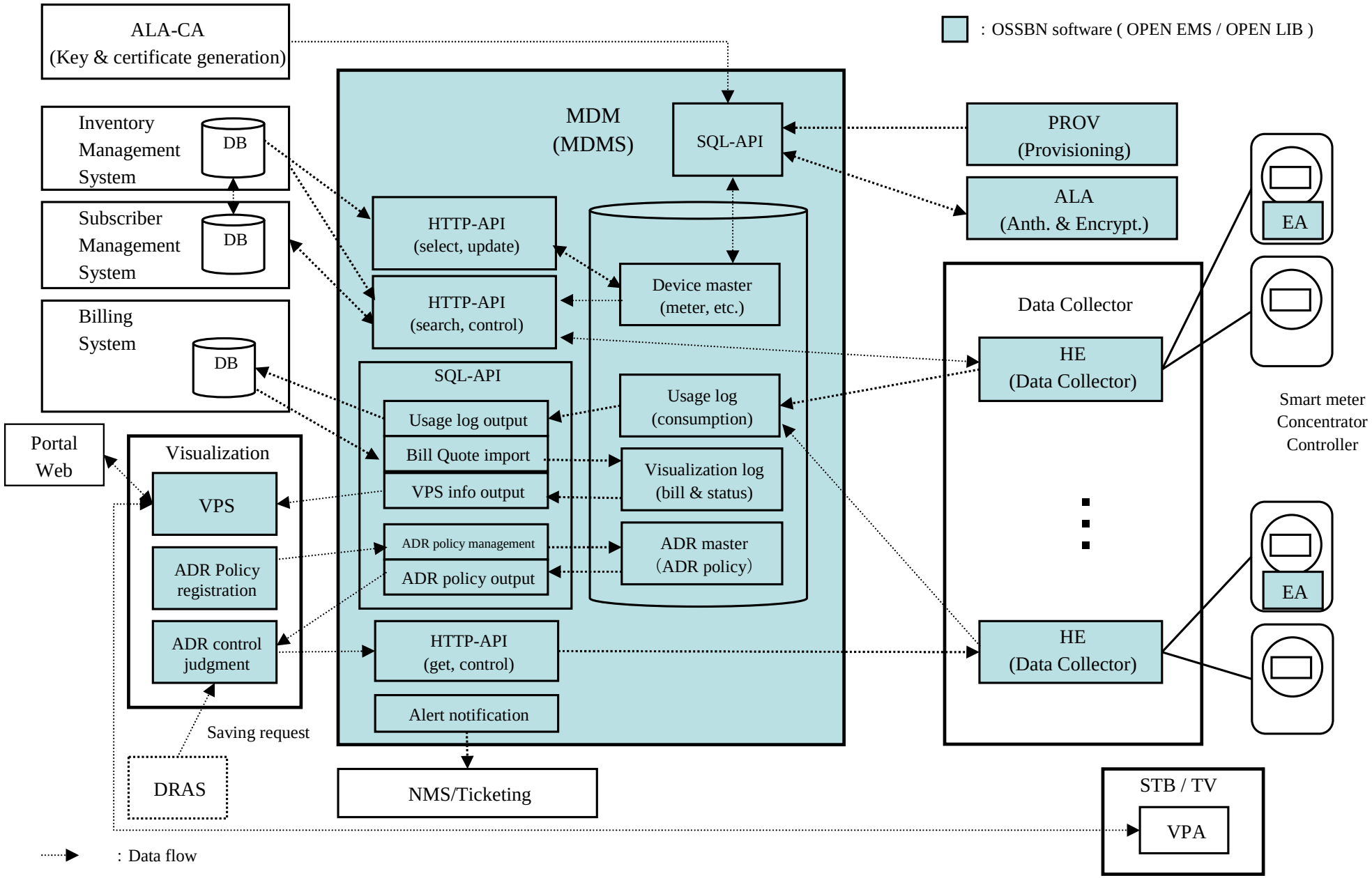
Structure of MDM/HE



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Function List (VPA/VPS)

VPA

Function	Category	Description
Configuration management	Standard	Configuration of VPA by editing text file.
HTTP client		Usage history record download from VPS by http. UI output to TV formatted in chart or 2D graph.
Meter ADR	Optional	ADR policy registration from VPA UI, comparing with simulated usage forecast.
Saving recommendation		Recommendation to assist consumer's ADR policy criteria selection.

VPS

Function	Category	Description
Configuration management	Standard	Configuration of VPS by editing text file.
HTTP-API		RESTful APIs for Portal Web system. Used for VPA client authentication, usage history record request, device control, etc. Http is used.
Operation log		VPS operation log output to Syslog.
MDM integration		MDM-DB connection to call SQL stored procedures. Used for VPS account management, VPA binding to physical device, ADR policy management, VPS log extraction, ADR log extraction, etc.
PROV integration		TR-069 File download request to PROV ACS by EJB for VPA installation to the targeted STB device.
Mater ADR	Optional	Designing of ADR policy (from/to time, thresholds, acceptable savings etc.) in accordance with past consumption tendencies. When EiEvent received, make decision whether ADR action is required. If yes, issue reservation command to the meter to change capacity. ADR action log (= contribution result) forwarding to northbound for incentive identification.
Saving recommendation		Saving recommendation mail sending to consumers when consumption exceeds pre-configured criteria.
Saving ranking		Public awarding of contribution for CO2 reduction in a specific area. Ranking for cash-back or incentives.
OpenADR		Receive EiEvent from DRAS, forward event to MDM.

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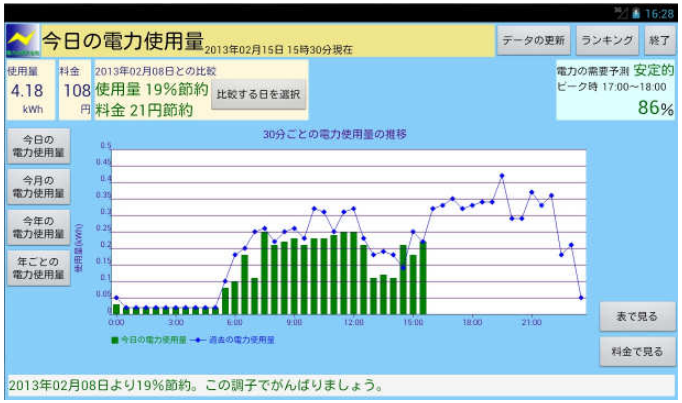
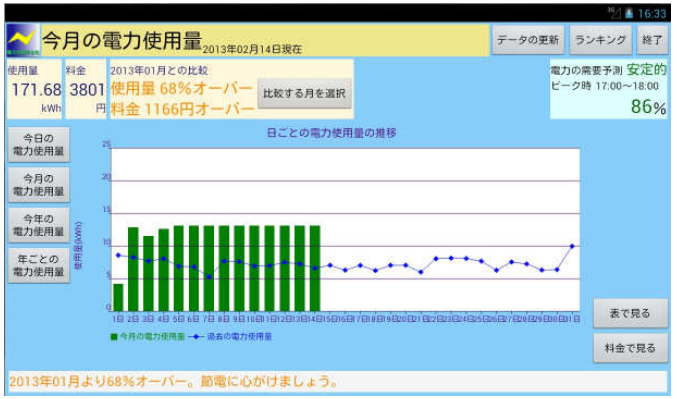
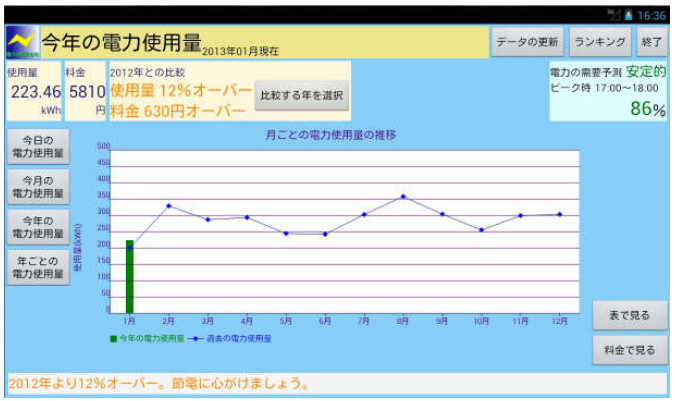
Sample GUIs of VPA





Display personal energy consumption info on TV via CATV-STB or OTT-STB.

VPA is just an Android application therefore could be downloaded into any android devices.



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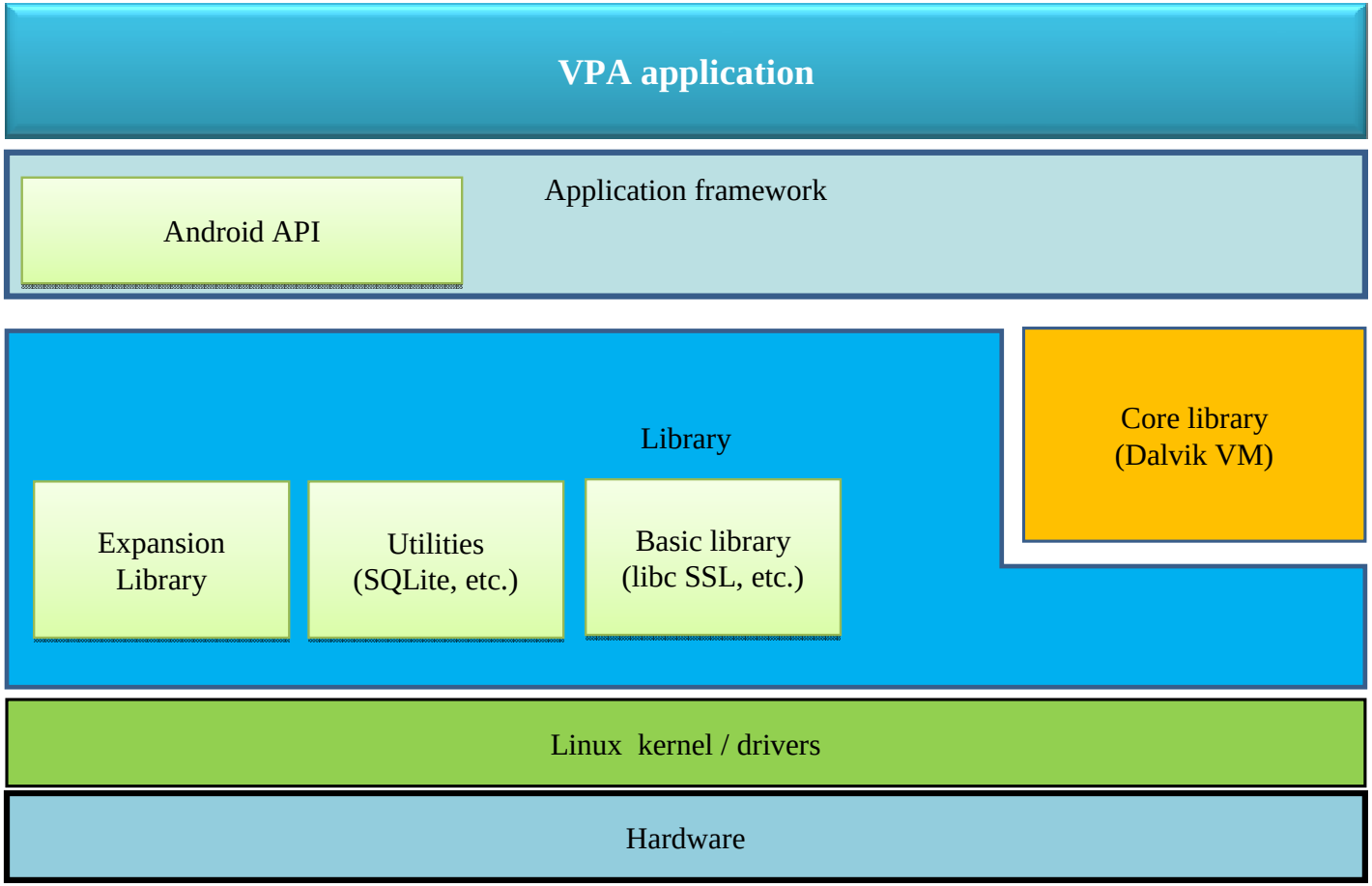
Required Environment for VPA



No		OS/middleware	Version	Remarks
1	OS	Android OS	4.0 or later	
2	VM	Dalvik VM		
3	Framework	Android API	Android OS 4.0 (API 14)	Android

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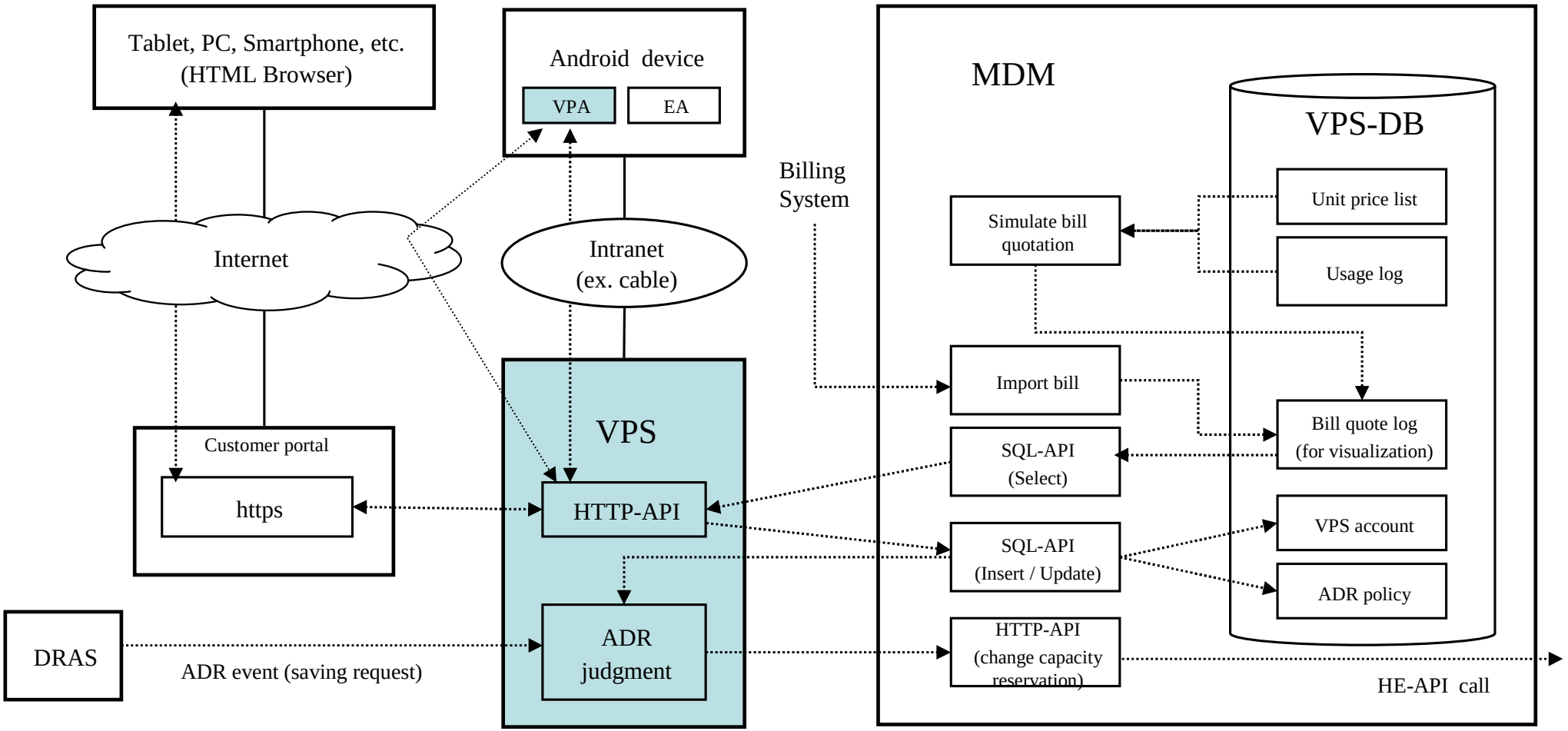
Structure of VPS



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Function List (EA)

Function	Category	Description
Configuration management	Standard	Configuration of EA by editing text file.
Daemon agent		Resident program to provide an application agent service. Includes provisioning client implementation. Provisioning is customizable in accordance with the targetted network policy.
Operation log		EA operation log output to text file.
Activity monitor & self recovery		Periodic EA activity check. Restarting EA if PID lost or long time no activity found.
Encryption	Optional	SSL/TLS authentication & encryption. SSH port forwarding. Communication with ALA, which is OSSBN original authentication & encryption framework.
TR-069 CPE *E5.4~		BBF TR-069 CWMP protocol implementation. For HGW, STB an HEMS controller. STUN is configurable in case of NAT exist between head-end and HAN.
IEC62056		IEC62056 DLMS/COSEM data model & protocol implementation. For meter device. Mater ADR implementation is included in this option.
SNMP agent *E5.4~		SNMP agent for HEMS controller, HGW, STB devices.
OpenADR *E6~		OpenADR data model & protocol implementation. For HEMS controller device. Execute pre-defined action when EiEvent received. Respond to DRAS if request received.
ANSI C.12 * Currently not planned		ANSI C.12 protocol implementation. For meter device.
SEP2.0 * Currently not planned		SEP2.0 & Zigbee data model & protocol implementation. For HEMS controller device.
ECHONET Lite * Currently not planned		ECHONET Lite protocol implementation. For HEMS controller device.

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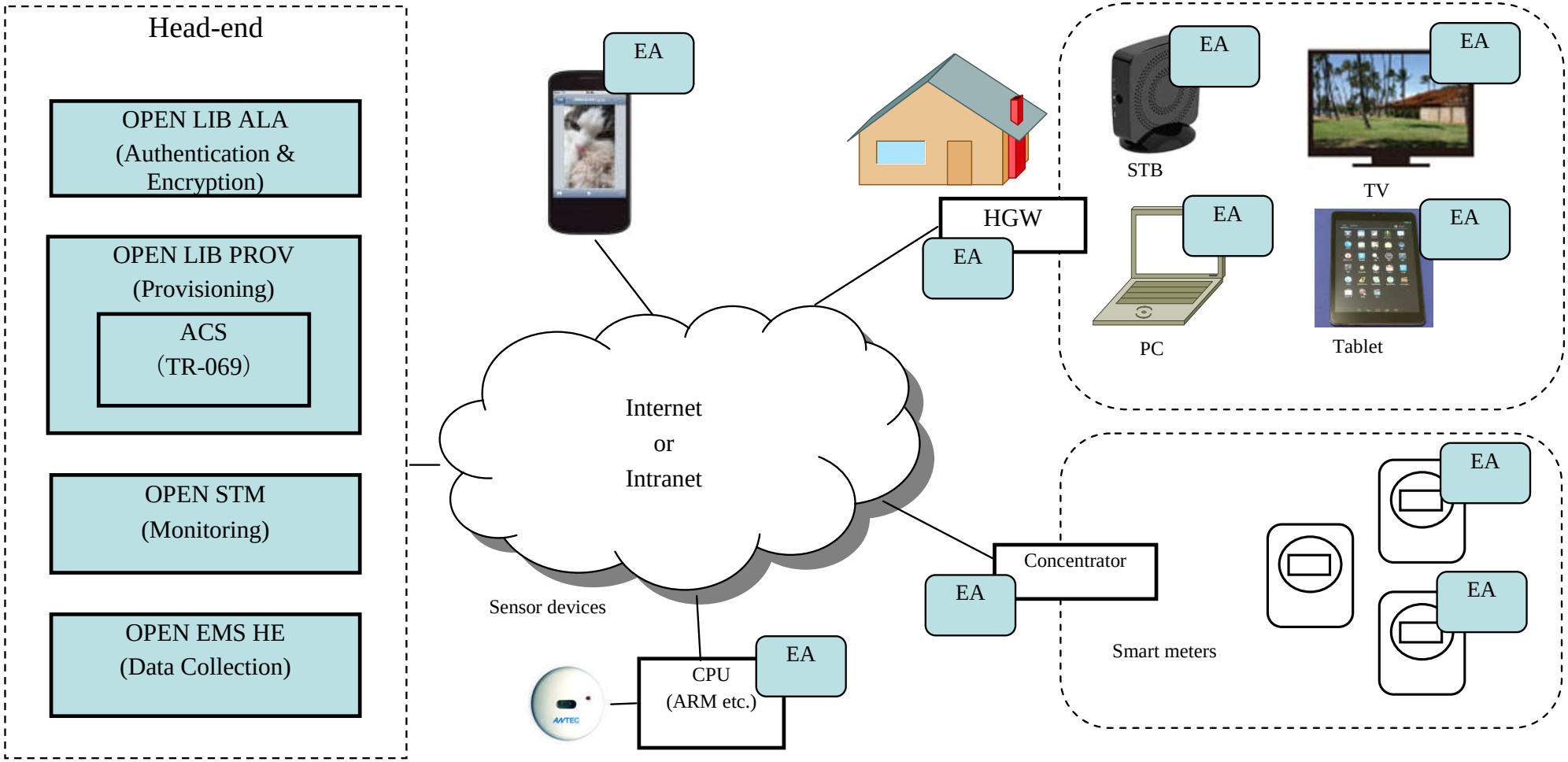
System design example (EA)



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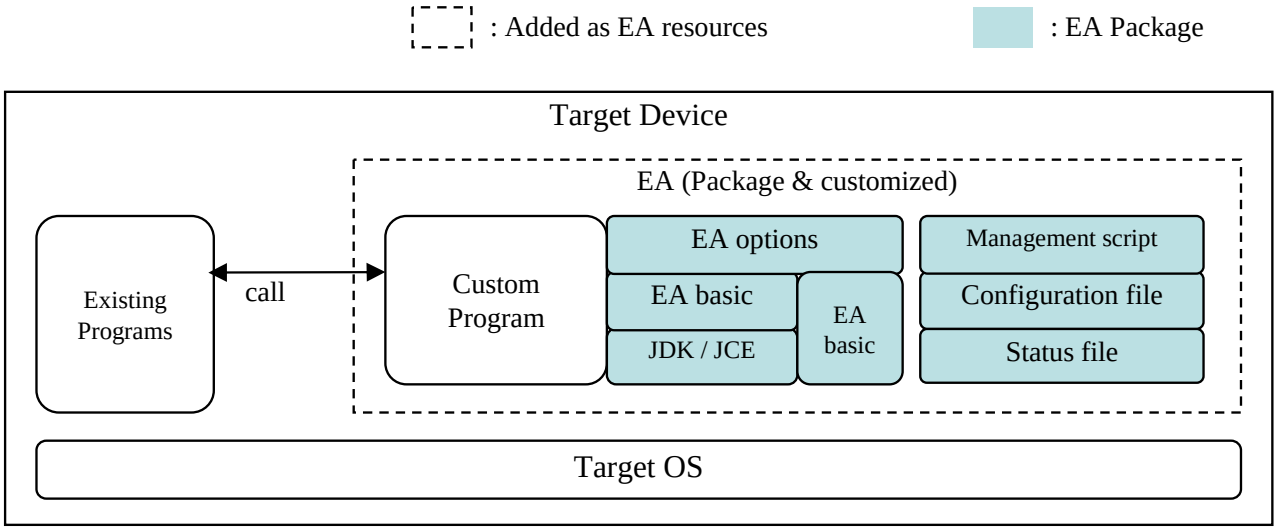
Structure of EA



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Function List (PROV/ALA)

PROV

Function	Category	Description
Initial parameter offering	Standard	Initial parameter offering as a response to boot inform from PROV client. DHCP Discover, CWMP Inform or other scheme will be used for boot notification.
Download request		Download request to client for downloading configuration file, firmware image, etc. from file server.
Clock synchronization		SNTP/NTP service for PROV client.
MDM integration		MDM-DB connection to update status info for device status search called from northbound.
ALA integration		Common key generation request to ALA Syslog.
Massaging to other systems	Optional	Propagate processing timing to other systems by asynchronous protocol ex.) Syslog, mail, etc.
File server		File server for file downloading. TFTP, FTP, SFTP, FTPS, HTTP could be configurable.
TR-069 ACS		Processing request ex.) download request, reset, etc. Event or message receiving by Inform. APIs for northbound.

ALA

Function	Category	Description
Private CA (ALA-C)	Standard	Generate public key pair and X.509 certificate.
Certification management (ALA-C)		Certificate life cycle management. Active, deactivated, lost, violated, etc…
Periodic common key update (ALA-S)		Periodic common key update by public key encryption method. Processing period is configurable.

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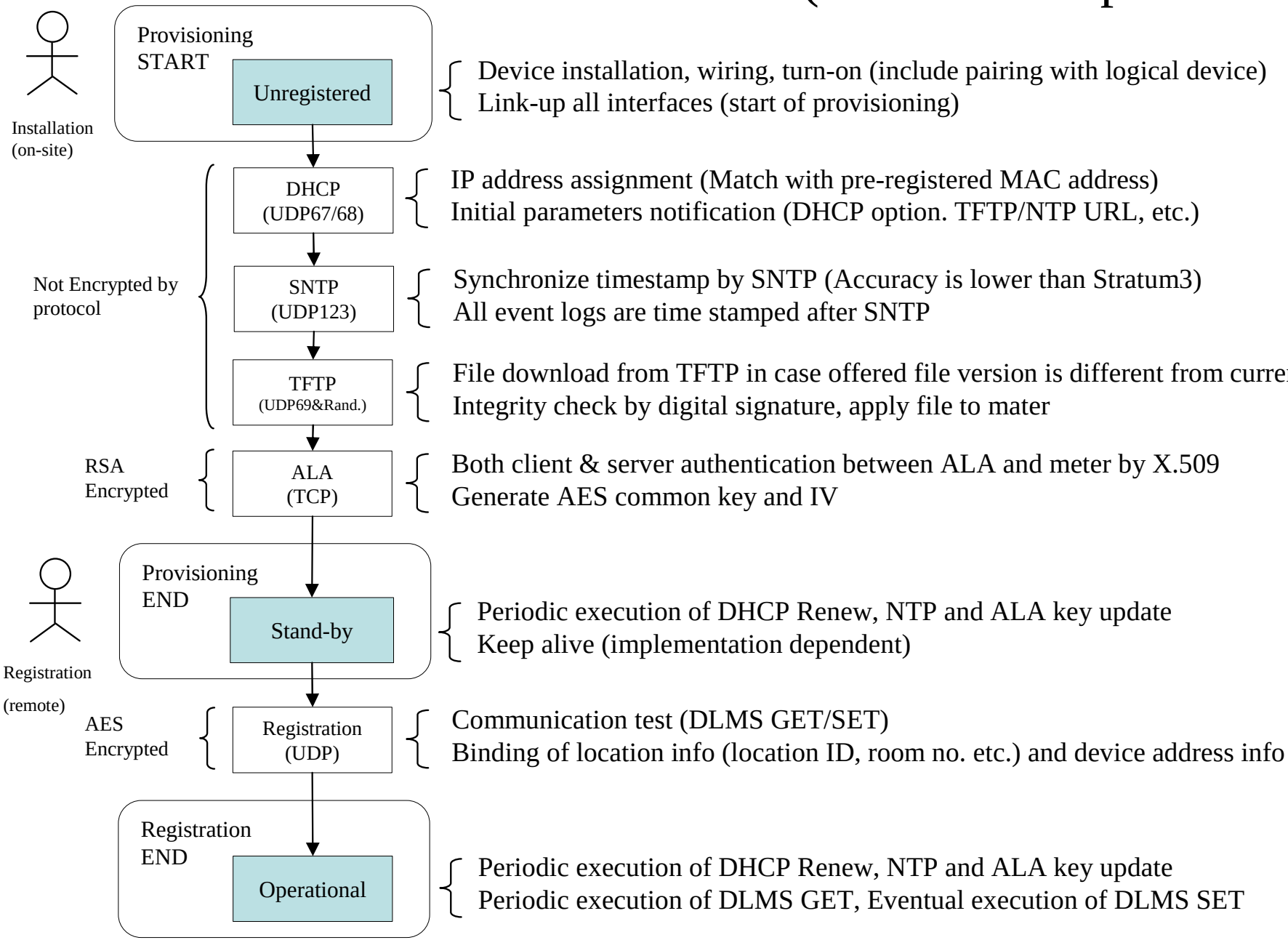
Example of PROV Sequence (Smart mater provisioning)



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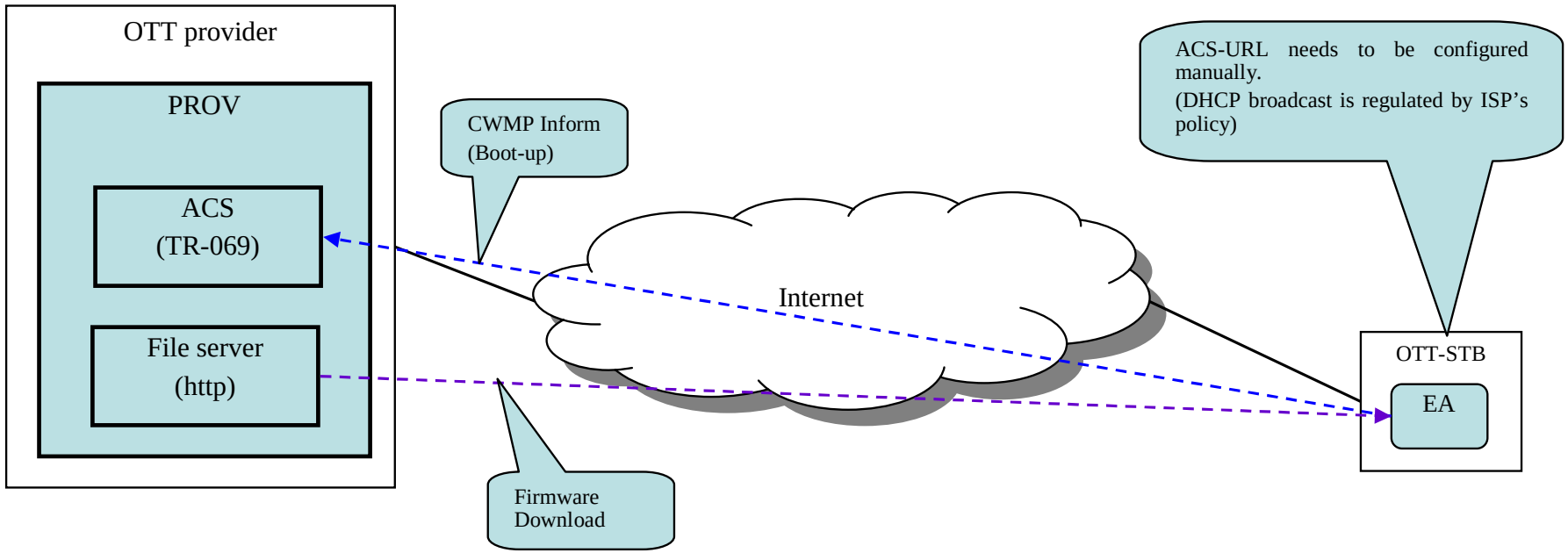
Example of PROV implementation （OTT-STB provisioning）



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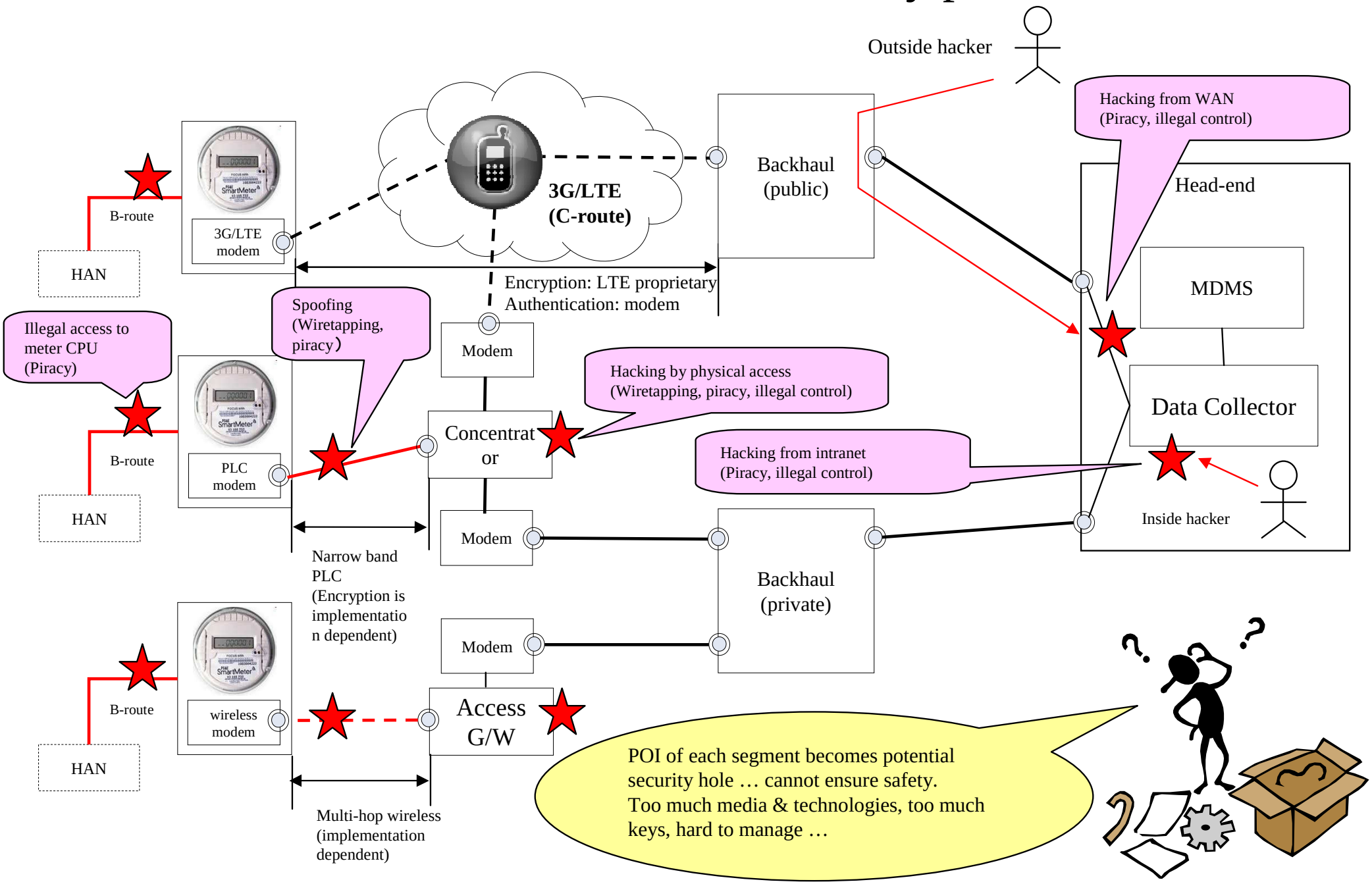
Potential security problems before ALA



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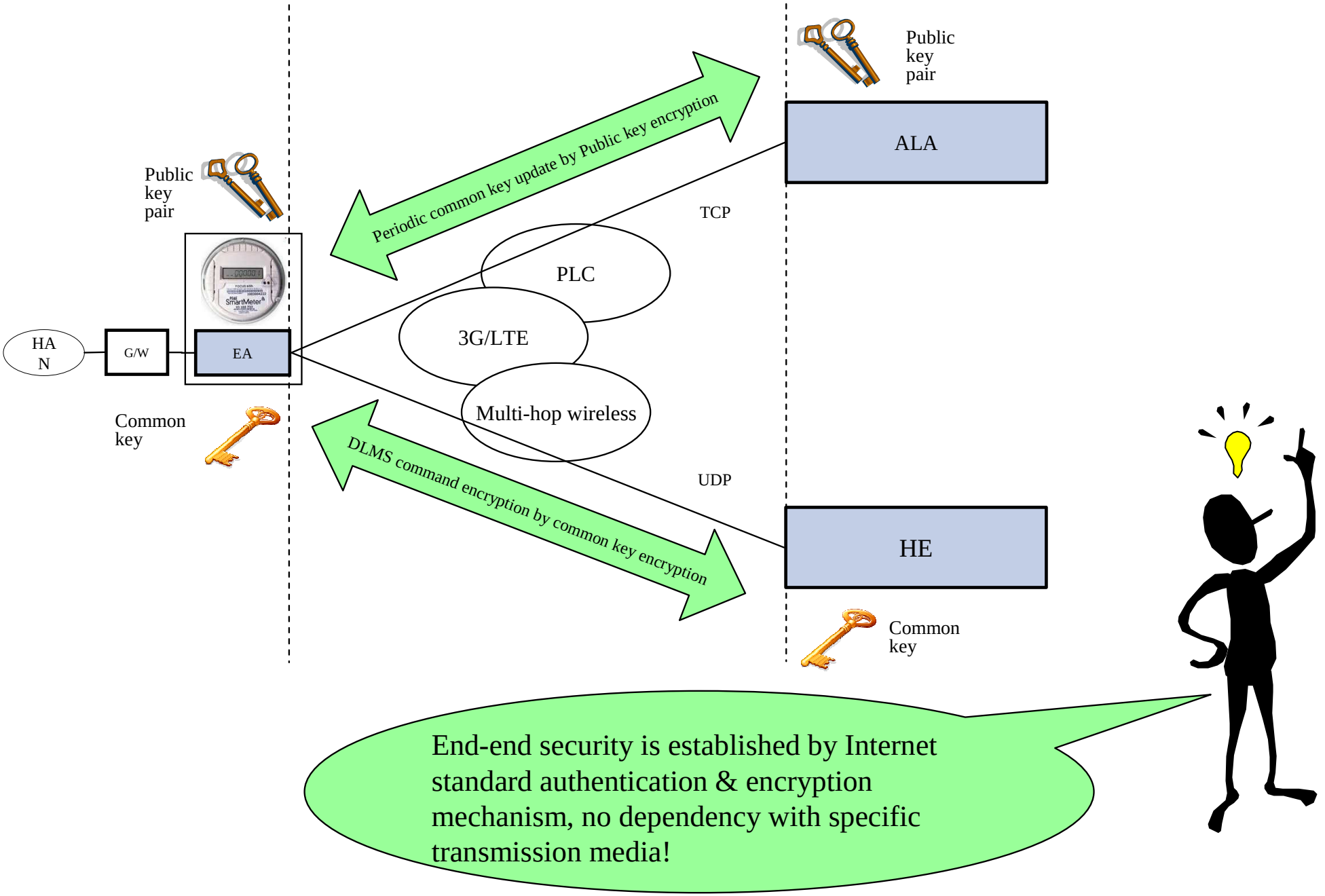
After ALA implementation



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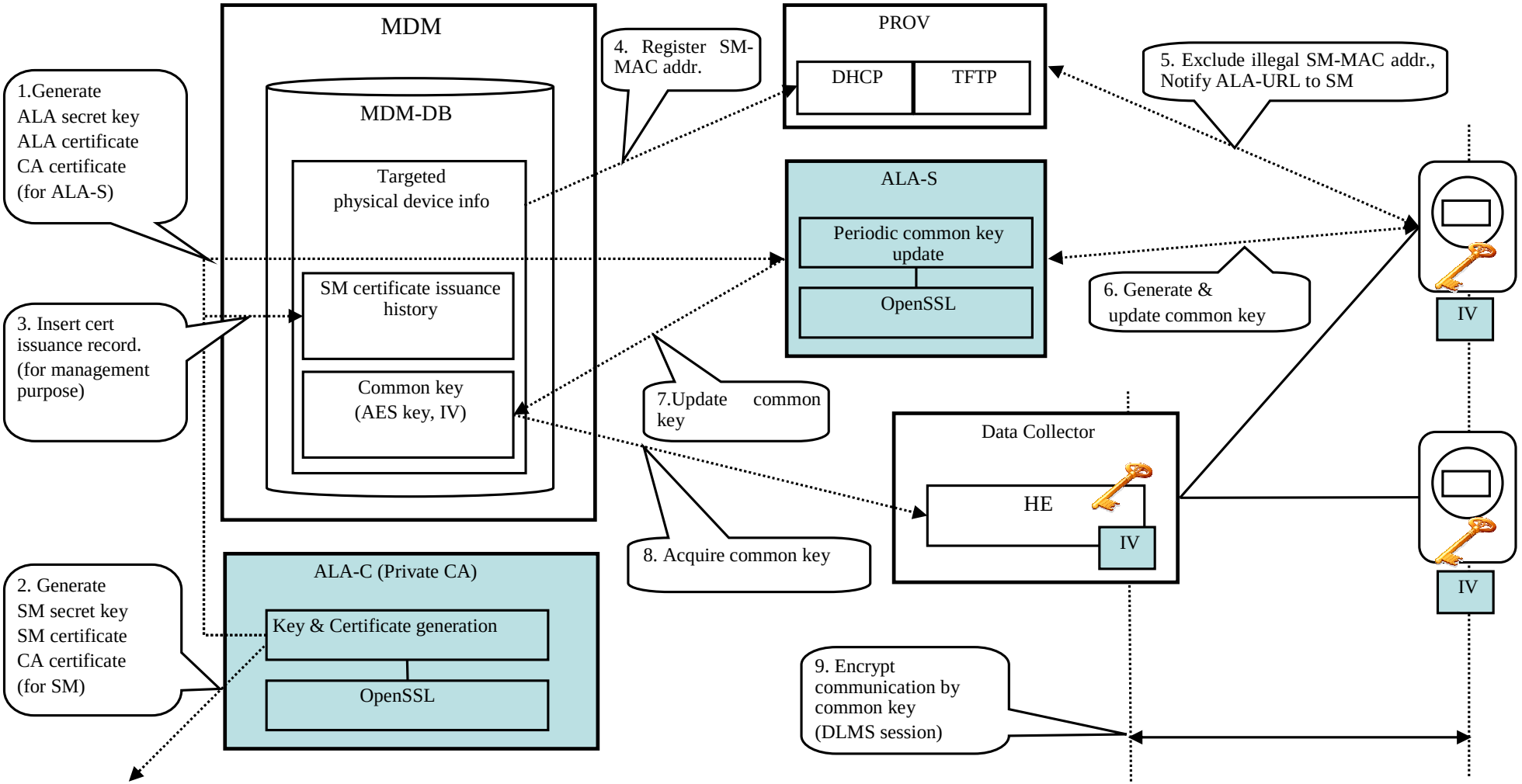
ALA system design example (with smart mater)



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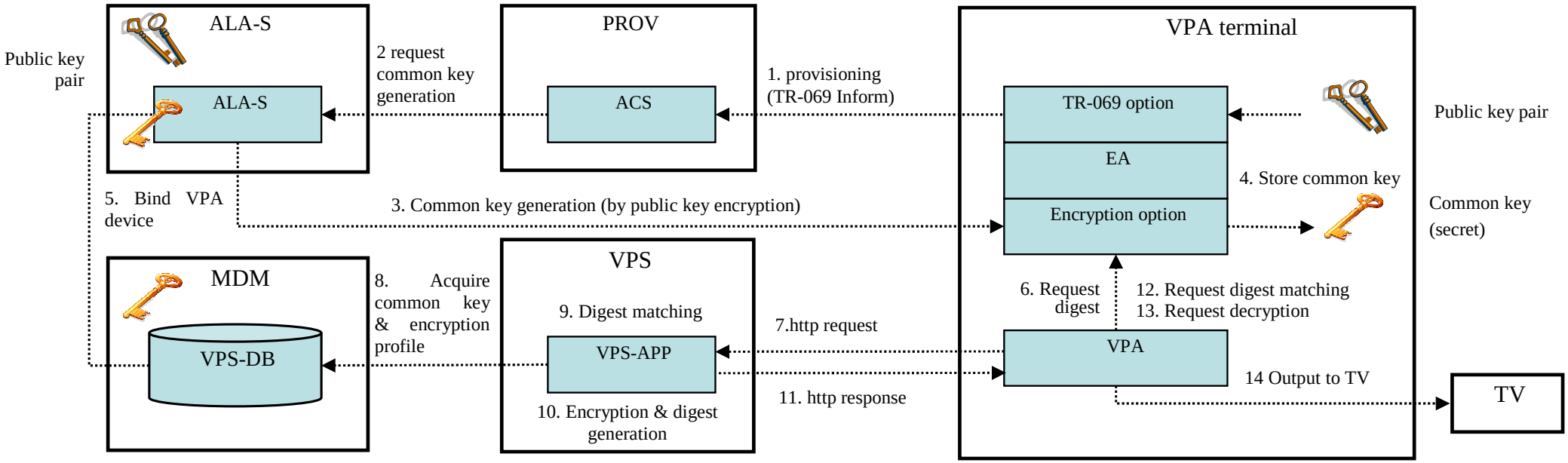
ALA system design example (with OTT-STB)



- What's unique ?
  - "Key request from ALA" approach

    ALA works as client, not as a server, in the common key generation process. This approach move location of PRNG from poor terminal device environment to rich cloud environment. Not only to save processing resources but to avoid potential violation risk could also be expected, cause PRNG selection at cloud side could be more reasonable.

  - "No heavyweight https but lightweight http" approach

    Only "http post" is used without heavyweight public key encryption in every session. All data are securely encapsulated in the AES encrypted XML file,

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Roadmap

Product	2014				2015	
	1-3	4-6	7-9	10-12	1-3	4-6
CE			5.4 TR-069	5.5 MDM ready		
AG/PM	5.1 HE ready	5.3 ALA/PROV ready			6.1 Pacemaker Integration	
PROV	5.1 EA ready					
ALA						
EA	5.1 IEC62056		5.4 TR-069/SNMP			6.2 OpenADR
HE		5.3 Meter ADR				
MDM				5.5 Alert notification		
VPS	5.1 MDM ready					
VPA						

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If any Questions

Send your message to

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Thanks!

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